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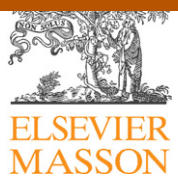

CLINICAL RESEARCH

Insufficient therapeutic management of hypertensive patients with renal failure in France

Insuffisance thérapeutique chez le patient hypertendu présentant une atteinte rénale en France

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Chronic renal failure;
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Angiotensin receptor blocker;
Proteinuria;
Microalbuminuria

Summary
Background. — Hypertension is both the cause and consequence of chronic renal failure (CRF). The prevalence of CRF, which itself is a cardiovascular risk factor, is not well known in France.
Aims. — To estimate the prevalence of renal dysfunction among hypertensive patients who were seen by general practitioners (GP); to assess the drug management of hypertension in these patients according to their renal status.
Methods. — A transversal observational study among patients of both genders aged 18 or more, with arterial blood pressure greater than 130/80 mmHg (i.e., over CRF-recommended blood pressure) or under antihypertensive drugs who were recruited in France by GP.
Results. — Among the 2315 included patients, 1908 could be analyzed for their renal function. Of these, 70.5% had an estimated glomerular filtration rate (GFR) of 89 ml/min per 1.73 m^2 or lower. One third of these patients (31.4%) were suffering from renal failure (GFR $\leq$ 59 ml/min per 1.73 m^2). CRF was moderate in 27.9% of patients, severe in 2.20% and terminal (GFR < 15 ml/min per 1.73 m^2) in 1.26%. At least one antihypertensive drug was taken by 1952 patients (84.3%), regardless of the patient's renal status.
Conclusion. — Hypertensive patients who are seen by GP have a high level of renal disturbances and many of them do not reach recommended blood pressure values. This highlights the

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importance of an early detection of renal dysfunction avoiding progression towards end-stage renal failure and an adapted antihypertensive drugs prescription, such as angiotensin-converting enzyme inhibitors and angiotensin receptor blocker, acting as renal protectors.

MOTS CLÉS
Insuffisance rénale chronique ;
Hypertension ;
Inhibiteur de l'enzyme de conversion ;
Antagoniste des récepteurs de l'angiotensine 2 ;
Protéinurie ;
Microalbuminurie

Résumé
Introduction. — L'hypertension artérielle est à la fois la cause et la conséquence de l'insuffisance rénale chronique (IRC). La prévalence de l'IRC, elle-même facteur de risque cardiovasculaire majeur, est mal estimée en France.
Objectifs. — Estimer la prévalence de l'atteinte rénale chez des patients hypertendus vus en consultation de médecine générale ; évaluer la prise en charge médicamenteuse de l'hypertension des patients inclus en fonction de leur statut rénal.
Méthodes. — Étude observationnelle transversale chez des patients adultes présentant une pression artérielle supérieure ou égale à 130/80 mmHg (*i.e.*, dépassant les objectifs tensionnels pour l'IRC) ou prenant un traitement antihypertenseur, recrutés en France par des médecins généralistes.
Résultats. — La fonction rénale de 1908 sur 2315 patients inclus dans l'étude a été analysée et 70,5 % avaient un débit de filtration glomérulaire (DFG) estimé inférieur ou égal à 89 ml/min/1,73 m^2. Un tiers des patients (599 sur 1908 = 31,4 %) souffraient d'une atteinte rénale (DFG $\leq$ 59 ml/min par 1,73 m^2). L'IRC était modérée chez 27,9 % des patients, sévère chez 2,20 % des patients et terminale chez 1,26 % des patients. Au total, 1952 patients (84,3 %) prenaient au moins un traitement antihypertenseur, quel que soit leur statut rénal.
Conclusion. — La population hypertendue vue en médecine générale présente une prévalence des troubles rénaux élevée et n'atteint pas, pour une grande part, les objectifs tensionnels recommandés. Ces résultats soulignent l'importance d'un dépistage précoce d'un dysfonctionnement rénal évitant la progression vers l'IRC terminale et celle d'une prescription adaptée d'antihypertenseurs inhibiteurs de l'enzyme de conversion et antagonistes des récepteurs de l'angiotensine 2 qui posséderaient des effets néphroprotecteurs.

Introduction

The incidence rates of chronic renal failure (CRF) are constantly increasing in France and in the developed world. In 2006, the French Renal Epidemiology and Information Network (REIN) reported that 6509 patients with end-stage renal disease from 16 French regions covering 79% of the population had begun initial renal replacement therapy (RRT) for CRF (dialysis or graft) [1]. The asymptomatic or poorly symptomatic nature of renal dysfunction explains why it is often discovered at a very late or even terminal stage, requiring urgent RRT and resulting in a much less favorable prognosis than if the RRT had been properly prepared.

Arterial hypertension (AH) is both the cause and the almost inevitable complication of CRF [2]. Hypertension increases the risk of complications in CRF patients and, independent of the etiology of renal failure, speeds up the deterioration of renal function. It also favors the early onset of cardiovascular complications, accelerates the progression of cardiovascular lesions and increases early mortality. Patients with renal failure often have isolated systolic hypertension with a normal or low diastolic pressure. It is systolic pressure which best indicates the risk of progression towards end-stage renal failure. Furthermore, it has been shown that renal failure is an important risk factor for all-cause and cardiovascular mortality [3].

Since 2003, numerous recommendations have been published pertaining to blood pressure targets in the case of CRF [4—8]. Thus, according to international recommendations of JNC VII followed by ANAES [4], the target blood pressure in renal failure patients should be 130/80 mmHg.

The adequate control of arterial blood pressure is recognized to be an essential factor in slowing down the progression of CRF. However, screening for renal failure is not routine in the case of hypertension [9,10]. Given the role of hypertension in the progression of CRF, we considered it important to examine the distribution of hypertensive patients according to their renal disease stage and the management of their hypertension. This survey was conducted over the course of 1 week in patients from all over France who consulted their general practitioner (GP) presenting with blood pressure greater than or equal to 130/80 mmHg and/or who were undergoing antihypertensive therapy.

Material and methods

This national and transversal observational study conducted over 1 week concerned patients recruited consecutively in all of France by a representative sample of GP. The survey was conducted in accordance with legal requirements. The GP were chosen at random from a comprehensive database of French GP and were stratified first by region, then by telephone interview. Inclusion criteria for patients were the following: patients of both genders, aged 18 years or more and presenting with a systolic blood pressure (SBP) and/or a diastolic blood pressure (DBP) greater than or equal to

130/80 mmHg or undergoing antihypertensive therapy. The threshold of 130/80 mmHg refers to the target blood pressure recommended in the case of renal failure [4], so as to identify those hypertensive patients presenting with kidney problems.

For each patient, the GP collected in a registry demographic (sex, age, weight, height), clinical data (SBP/DBP: GP were asked to record the second of two blood pressure readings at an interval of a few minutes) the duration of hypertension, serum creatinine, current antihypertensive treatments and finally, metabolic and environmental data concerning the patient's cardiovascular, renal and diabetic status.

The body mass index (BMI = weight/height^2) and the body surface area [BSA = (weight $\times$ height/3600)$^{0.5}$] [11] were calculated a posteriori. The glomerular filtration rate (GFR) was calculated on the basis of serum creatinine (μmol/l), age and weight using the Cockroft and Gault formula [12]. The GFR was scaled to the BSA [13].

For the purposes of this study, the ANAES classification criteria for chronic renal disease and its severity were used [13]: moderate renal failure (GFR between 30 and 59 mL/min per 1.73 m^2), severe renal failure (GFR between 15 and 29 mL/min per 1.73 m^2) and end-stage renal failure (GFR < 15 mL/min per 1.73 m^2). Patients with a GFR between 60 and 89 mL/min per 1.73 m^2 presenting with renal disease markers for more than 3 months were considered to have chronic kidney disease.

Statistical analysis

The statistical analysis was performed using SAS 9.1 (SAS Institute, Cary, NC). The quantitative data are presented as the number of patients (n), mean ± standard deviation, median and range. The qualitative data are presented as the number of patients (n) and as percentages of the total data set. Missing data were not treated in any special manner.

Group comparisons were conducted using the following tests: Student's t-test, ANOVA, Kruskal-Wallis, Chi-square test and Fisher's exact test. Furthermore, the Chi-square test for trend was used for the analysis of the relation between a categorical variable reflecting a grading (such as the degree of renal failure) and a nominal variable with two states (such as medical history). A P-value of < 0.05 was considered statistically significant.

Results

Patient characteristics

The demographic and clinical patient characteristics are shown in Table 1. A total of 2315 (49.4% male), with a mean age of 65 ± 13.6 years were recruited by 202 GP from 4 to 10 June 2007. The mean BMI was 27.5 ± 5.47 and 896 patients (39.8%) were overweight (25 ≤ IMC < 30) and 596 (26.5%) were obese (BMI ≥ 30). The mean values for SBP and DBP were 145 ± 12.2 and 84.5 ± 8.65 mmHg, respectively. The median duration of hypertension was 8.0 years.

Median serum creatinine, measured in 1959 patients, was 80 μmol/L (CI 95%: 85—92) and median GFR of 72.5 (CI 95%: 114—137). The serum creatinine was higher in men (median: 88 μmol/L) than in women (median: 76 μmol/l) (p < 0.001). The median GFR was 78 mL/min per 1.73 m^2 in men versus 67 in women (P < 0.001). Likewise, the serum creatinine and GFR differed according to age (median serum creatinine in micromole per litre — 18 ≤ age < 40: 78; 40 ≤ age < 60: 79; age ≥ 60 years: 82 ; P < 0.001; median GFR in millilitre per minute per 1.73 m^2 — 18 ≤ age < 40: 103; 40 ≤ age <60: 90; age ≥ 60 years: 63 ; P < 0.001).

The study of hypertension risk factors according to HAS recommendations [7] shows, that in 85% of men and 66.2% of women included in the study, age was a risk factor. In addition, 35.2% of patients had a cardiovascular family history, 21.4% were diabetic, 48.6% of patients presented with dyslipidemia current or past and 29.6% were smokers or exsmokers.

We also compared the characteristics of patients having a reported serum creatinine value (''creatinine group'', n = 1 959) with those without (''non-creatinine group'', n = 356). Overall, it seems that the age-related pathologies and criteria were more common in the ''creatinine group''. It is of note that more patients in the ''creatinine group'' took at least one ACE inhibitor or an A2RB, which could be explained by the fact that renal failure had been detected in these patients (results not shown).

Evaluation of renal function

Table 2 shows the prevalence of each renal disease stage among the ''creatinine group'' — the GFR was able to be calculated in 1908 patients — along with the percentages of patients presenting with renal disease markers. Of these, 1345 patients (70.5%) had a GFR less than or equal to 89 mL/min per 1.73 m^2. The percentage of patients presenting with chronic kidney disease was 1.47%. Furthermore, the prevalence of patients presenting with kidney damage was 31.4%. In this cohort, 27.9% (n = 533) had moderate renal failure, 2.20% (n = 42) had severe renal failure and 1.26% (n = 24) showed end-stage renal disease. In addition, when assessing renal disease markers, microalbuminuria was detected in 14.6% and proteinuria in 9.6% of cases.

Therapeutic management of hypertension according to the renal disease stage

In total, 1952 out of 2315 (84.3%) patients took at least one antihypertensive drug. Focusing on patients with renal failure (DFG ≤ 59 mL/min per 1.73 m^2) reveals that:

- among 550 patients (91.8%) treated for AH, 42 out of 544 (7.7%; six patients had incomplete blood pressure data) had good blood pressure control and 502 out of 544 (92.3%) had poor blood pressure control;
- in 49 cases (8.2%), blood pressure was neither treated nor controlled.

Patient groups defined by their renal disease stage differed according to whether or not they had taken antihypertensive medication (P = 0.002), the proportion of patients taking at least one drug increased with the severity of the renal disease (Chi-square test for trend, P < 0.001) (Table 3).

Regardless of renal status, the majority of patients took between one and two antihypertensive drugs (e.g., mean

Table 1 Demographic and clinical characteristics of patients.

	n	*n* = 2315
Men	2313	1143 (49.4)
Age (years)		65.0 ± 13.6
Patients ≥ 75 years		647 (27.9)
Men > 50 years		972 (85.0)
Women > 60 years		775 (66.2)
Body mass index (kg/m^2)	2253	27.5 ± 5.47
Body surface area (m^2)	2253	1.88 ± 0.22
SBP (mmHg)		
Mean ± S.D.	2303	145 ± 12.2
Median		142
Range		80—223
DBP (mmHg)		
Mean ± S.D.	2290	84.5 ± 8.65
Median		85
Range		50—142
Duration of hypertension (years)	2131	8
Serum creatinine (μmol/L)		
Mean ± S.D.	1959	89 ± 78
Median		80
Range		1—93
CI 95%		[85; 92]
Glomerular filtration rate (mL/min per 1.73 m^2)		
Mean ± S.D.	1908	126 ± 263
Median		72.5
Range		5.05—6905
CI 95%		[114; 137]
History of renal disease		116 (5.01)
Family history of renal disease		88 (3.80)
Cardiovascular family history*		816 (35.2)
Left ventricular hypertrophy documented by		
ECG		84 (3.63)
Ultrasonography		113 (4.88)
ECG + ultrasonography		174 (7.52)
Dyslipidemia**		
Currently		885 (38.2)
History		240 (10.4)
Current diabetes		495 (21.4)
Duration of diabetes (years)	441	9
Type of diabetes		
Type 1	493	52 (10.5)
Type 2		404 (81.9)
Other type		37 (7.51)
Tobacco smoking		
Currently		303 (13.1)
History		383 (16.5)

Data are expressed in *n* (%), median or mean ± standard deviation (S.D.).

* Myocardial infarction or sudden death before the age of 55 years in the father or any other male first-degree relative, myocardial infarction or sudden death before the age of 65 years in the mother or any other female first-degree relative, early CVA (< 45 years)

** LDL cholesterol greater than 1.60 g/L (4.1 mmol/L), HDL cholesterol less than or equal to 0.40 g/L (1 mmol/L) for both genders.

Table 2 Prevalence of renal function disorders in patients with measured serum creatinine.

Stage of chronic kidney disease in patients with measured GFR	
Stage of chronic kidney disease	
No renal involvement ($n = 1908$)	
GFR ≥ 90	563 (29.5)
GFR ≥ 90 or $60 \leq$ GFR < 89 with no renal disease markers during more than 3 months	1281 (67.1)
Renal involvement ($n = 1908$)	
GFR ≤ 89	1345 (70.5)
$60 \leq$ GFR ≤ 89 with renal disease markers during more than 3 months (chronic kidney disease)	28 (1.47)
GFR ≤ 59	599 (31.4)
$30 \leq$ GFR ≤ 59 (moderate renal failure)	533 (27.9)
$15 \leq$ GFR ≤ 29 (severe renal failure)	42 (2.20)
GFR < 15 (end-stage renal failure)	24 (1.26)
Renal disease markers in patients with measured serum creatinine	
Microalbuminuria ($n = 1959$)[a]	286 (14.6)
Proteinuria ($n = 1959$)[b]	188 (9.6)
Pathological hematuria ($n = 1959$)[c]	80 (4.1)
Pathological leukocyturia ($n = 1959$)[d]	70 (3.6)
Morphological abnormalities at renal ultrasonography ($n = 1959$)[e]	76 (3.9)

Data are expressed in *n* (%). GFR: glomerular filtration rate (mL/min per 1.73 m^2).
[a] Microalbuminuria: 20—200 μg/min or 30—300 mg per 24 h, albuminuria/creatininuria ratio greater than 2 mg/mmol.
[b] 300 mg per 24 h, proteinuria/creatinemia ratio greater than 200 mg/g.
[c] Erythrocytes greater than 10/mm^3 or 10,000/mL.
[d] Leukocyturia: leukocytes greater than 10/mm^3 or 10,000/mL.
[e] Size asymmetry, bumpy contours, small-sized kidneys, large polycystic kidneys, nephrocalcinosis, calculus, hydronephrosis.

for moderate CRF = 1.66 ± 0.97). Of the 1908 patients, 240 (12.6%) did not take any antihypertensive medication, 879 (46.1%) took one antihypertensive drug, 522 (27.4%) took two and 267 (14.0%) took at least three antihypertensive drugs.

Of the patients with severe renal failure, 66.7% took at least one diuretic, 31.0% at least one ACE inhibitor and 31.0% at least one A2RB. Among the patients with end-stage renal failure, 45.8% took at least one diuretic, 16.7% at least one ACE inhibitor and 37.5% at least one A2RB. Overall, the distribution of patients according to their renal disease stage differed according to the prescribed treatment and the percentage of patients treated tended to increase with the severity of renal disease. This was true for all treatments except for patients who took at least one A2RB or at least one β-blocker (Table 3). Furthermore, the number of patients taking at least one ACE inhibitor tended to increase with the severity of renal disease ($P = 0.061$).

Fig. 1 illustrates the management of microalbuminuria and/or proteinuria, with or without diabetes, in patients with renal failure, using ACE inhibitors and/or A2RB. In total, 32.3% of diabetics with proteinuria, 23.2% of diabetics with microalbuminuria, 29.6% of diabetics with both proteinuria and microalbuminuria, 37% of patients with proteinuria but without diabetes and 28.2% of patients with microalbuminuria without diabetes took neither ACE inhibitor nor A2RB. Conversely, 6.5% of diabetics with proteinuria, 5.8% of diabetics with microalbuminuria, 7.4% of diabetics with both proteinuria and microalbuminuria, 3.7% of patients with proteinuria but without diabetes and 2.6% of patients with microalbuminuria but without diabetes took one ACE along with an A2RB.

Discussion

This survey aimed to update data concerning the prevalence of renal dysfunction by taking into account the different stages of CKD and CRF as proposed by ANAES and to describe the therapeutic management of these patients in an ever-changing environment. Our study population, selected on the basis of criteria linked to AH (blood pressure over 130/80 mmHg and/or treatment with antihypertensive medication), is relatively old (65.0 ± 13.6 years) and made up of as many men as women. Our results are in line with those of previous studies which showed that renal function deteriorates progressively with age [9,14,15]. Moreover, while we observed that serum creatinine and GFR were higher in men than in women, a study of 2100 hypertensive patients recruited by cardiologists in private practice showed that renal failure began significantly earlier and was more severe in women than in men, while after the age of 70, there was no longer any difference between the two groups [9]. In this study, the mean age of patients (65.9 ± 12.2 years) and the mean duration of antihypertensive treatment were comparable to those observed in our study.

We found that 1023 patients (44.2%) had consulted a cardiologist, whereas only 144 (6.2%) had seen a nephrologist. All around the world, patients suffering from renal failure leave it too late before consulting a nephrologist, if at all. This problem of ''late referral'' seems very common and

Table 3 Analysis of antihypertensive treatments according to the stage of chronic kidney disease (blood pressure greater or equal to 130/80 mmHg, $n = 1908$).

			Chronic renal failure				
	(0) No renal involvement	(1) Chronic kidney disease GFR $\geq$ 60	(2) Moderate renal failure	(3) Severe renal failure	(4) End-stage renal failure	*P*	*P*-trend
	$n = 1281$	$n = 28$	$n = 533$	$n = 42$	$n = 24$		
Number of treatments							
Mean $\pm$ S.D.	1.33 ± 0.89	2.04 ± 1.23	1.66 ± 0.97	2.21 ± 1.20	1.63 ± 1.06		
0 ($n = 240$)	189 (14.7)	2 (7.1)	44 (8.3)	3 (7.1)	2 (8.3)	—	—
1 ($n = 879$)	635 (49.6)	9 (32.1)	214 (40.1)	10 (23.8)	11 (45.8)	—	—
2 ($n = 522$)	321 (25.1)	7 (25.0)	176 (33.0)	11 (26.2)	7 (29.2)	—	—
≥ 3 ($n = 267$)	136 (10.6)	10 (35.7)	99 (18.6)	18 (42.9)	4 (16.7)	—	—
Treatments							
≥ 1 treatment with ACE inhibitor ($n = 439$)	273 (21.3)	12 (42.9)	130 (24.4)	13 (31.0)	4 (16.7)	0.028	0.061
≥ 1 treatment with A2RB ($n = 772$)	508 (39.7)	11 (39.3)	215 (40.3)	13 (31.0)	9 (37.5)	0.830	—
≥ 1 treatment with diuretic agent ($n = 807$)	474 (37.0)	11 (39.3)	263 (49.3)	28 (66.7)	11 (45.8)	< 0.001	< 0.001
≥ 1 treatment with β-blocker ($n = 507$)	320(25.0)	7 (25.0)	158 (29.6)	12 (28.6)	10 (41.7)	0.127	—
≥ 1 treatment with calcium antagonist ($n = 532$)	322 (25.1)	14 (50.0)	157 (29.5)	18 (42.9)	8 (33.3)	0.002	0.003
≥ 1 treatment with central antihypertensive agent ($n = 101$)	51 (3.98)	2 (7.14)	42 (7.88)	5 (11.9)	1 (4.17)	0.003	< 0.001

Data are expressed in *n* (%); (0) GFR $\geq$ 90 mL/min per 1.73 m^2 or 60 $\leq$ GFR $\leq$ 89 mL/min per 1.73 m^2 with none of the five renal disease markers (microalbuminuria, proteinuria, pathological hematuria, pathological leukocyturia, morphological abnormalities at renal ultrasonography) during greater or equal to 3 months. (1) 60 $\leq$ GFR $\leq$ 89 with at least one of the five above-mentioned renal disease markers during greater or equal to 3 months. (2) 30 $\leq$ GFR $\leq$ 59. (3) 15 $\leq$ GFR $\leq$ 29. (4) GFR < 15. ACE inhibitor: angiotensin-converting enzyme inhibitor; A2RB: angiotensin II receptor blocker; *P*: the value of *P* is the result of the Chi-square test. *P*-trend: the value of *P* is the result of the Chi-square test for trend.

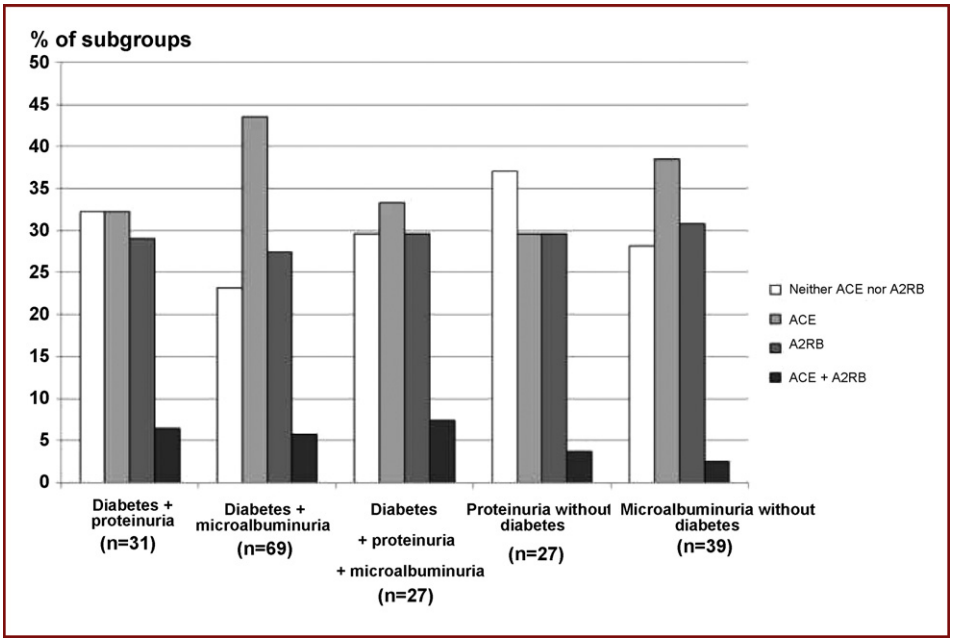

Figure 1. Use of ACE inhibitors without A2RBs, of A2RBs without ACE inhibitors, and of ACE inhibitors and A2RBs in patients with renal failure (GFR < 60 mL/min per 1.73 m^2), with or without microalbuminuria and/or proteinuria.

is associated with an increase in morbidity and mortality [16—18]. It is also of note that this survey was conducted after the publication of the reference values for the estimation of GFR based on serum creatinine by the Société française de biologie clinique and the Société française de néphrologie for the communication of laboratory results to the patient's physician. According to the results of our survey, there was no change in standard practices concerning the referral of patients to a nephrologist following the publication of these criteria.

In our cohort, 70.5% of patients presenting with a GFR inferior or equal to 89 mL/min per 1.73 m^2 and 1.47% presenting with a GFR between 60 and 89 mL/min per 1.73 m^2 had had renal disease markers for more than three months. Furthermore, the prevalence of patients for whom serum creatinine was reported and who presented with renal damage (GFR $\leq$ 59 mL/min per 1.73 m^2) was 31.4%. Among these patients, 27.9% (n = 533) had moderate CRF, 2.20% (n = 42) had severe CRF and 1.26% (n = 24) suffered from end-stage renal failure. In France, the overall prevalence of renal diseases is estimated at between two and three million [19]. According to the REIN registry data, the overall crude incidence rate of CRF patients treated by dialysis was 123 per million population (pmp) in 2003 in the seven regions participating in the registry, and in 2005, it was 139 pmp in the thirteen participating regions [20,21]. In the PHENOMEN study conducted in 2001 including 16,358 hypertensive patients treated by GP, which analyzed the prevalence of renal dysfunction for 8650 of these patients (mean age = 63 $\pm$ 12 years, 53% men) [10], 51% of patients (4411) exhibited signs of renal failure, 28% (2422) had mild renal failure (60 $\leq$ GFR < 80 mL/min), 22% (1903) had moderate renal failure (30 $\leq$ GRF < 60 mL/min) and 1% (44) had severe renal failure (GFR < 30 mL/min). In a sample with a similar mean age and male/female distribution, the results of our study are slightly higher, suggesting a progression of renal disease in France. Another French study conducted among hypertensive patients seen by cardiologists in private practice reported figures comparable to ours with a prevalence of CRF defined as a creatinine clearance inferior to 60 mL/min being 32%, and 61% when the threshold was fixed at 80 mL/min. In this study, mild to moderate renal failure was underdiagnosed with 71% of patients being subjectively considered as having normal renal function [9]. Moreover, hypertensive patients with CRF did not show more cardiovascular risk factors or comorbidities compared to patients with normal renal function and the prevalences of type 2 diabetes and hypercholesterolemia were similar in both groups. A British study reported a prevalence of CRF of 1701 pmp, with an overrepresentation of men and older patients when CRF was defined by serum creatinine superior to 150 μmol/L [22]. In the United States, the incidence of CRF is estimated at 6600 pmp, with one in 16 Americans having a creatinine clearance between 15 and 60 mL/min per 1.73 m^2 [23]. Recently, a study aiming to update the figures concerning the prevalence of CRF in the United States by means of the latest NHANES studies referring to NHANES 1999—2004, including 13,233 subjects aged 20 years or more (mean age = 46.2 $\pm$ 0.3 yrs), the prevalence of CRF stages 1—4 was 13.1% and gave a GFR greater than or equal to 90 mL/min per 1.73 m^2 for 40.7% of the population, a GFR between 60 and 89 mL/min per 1.73 m^2 for 51.2%, a GFR between 30 and 59 mL/min per 1.73 m^2 for 7.7% and a GFR between 15 and 29 mL/min per 1.73 m^2 for 0.35% of subjects [24]. The differences between these results and those of our study could be explained by the following facts:

- our population is older;
- our population was selected on the basis of blood pressure criteria (130/80 mmHg and treatment by an antihypertensive drug);

- these authors use the MDRD formula for the calculation of GFR [25].

We have shown that among patients for whom serum creatinine had been measured, microalbuminuria was found in only 14.6% and proteinuria in 9.6%. These results differ greatly from the MIRA survey, which aimed to investigate the epidemiology of microalbuminuria among patients with type 2 diabetes (563 patients of which 55% men, mean age = 64.7 ± 11.2 years, duration of hypertension =10.5 ± 6.9 years). In total, 349 out of 510 patients (68%) had blood pressure superior to 130/80 mmHg and 51% presented with microalbuminuria greater than 30 mg/L [28].

Our study shows that 31.4% of subjects included in the survey, that is one third of hypertensive patients seen by GP, present with renal failure. In this sub-group, approximately 92% of patients are being treated but in only 7% is blood pressure successfully controlled. These results are in line with other French studies, showing that the control of blood pressure in patients with CRF is poor with regard to the recommendations for good clinical practice [10,26].

In our study, among the patients whose blood pressure was superior to 130/80 mmHg, many had a lowered GFR or even renal dysfunction (only 22 out of 1908 patients had blood pressure inferior to 140/90 mmHg, a normal renal function and were not taking any hypertensive medication). Whilst the JNC report VII claims that hypertensive patients with renal failure should be treated rather aggressively with at least three antihypertensive drugs in order to achieve a blood pressure target of 130/80 mmHg, analysis of therapeutic management of hypertension in our study shows that few patients benefit from optimal treatment with 879 out of 1908 (46.1%) taking only one antihypertensive drug. Moreover, 687 out of 879 (78.2%) of patients treated with antihypertensive medication maintained a blood pressure superior to 140/90 mmHg (representing 36% of analyzed subjects) and 184 out of 687 (26.8%) presented with CRF. These results are in line with those of the NHANES III study, in which hypertensive subjects with increased serum creatinine had a mean blood pressure of 147/77 mmHg and 48% took only one hypertensive drug [27]. Another finding of the NHANES III study was that 3% of Americans had a raised serum creatinine, 70% were hypertensive and 75% of these hypertensive patients were being treated. Moreover, only 11% of these hypertensive patients had a blood pressure inferior to 130/85 mmHg [27].

The principle factors permitting to slow down the progression of renal dysfunction, especially in chronic glomerulopathies, are proteinuria and hypertension [8].

ACE inhibitors and A2RB are believed to have protective effects in patients with renal dysfunction and are thought to slow the progression towards end-stage renal disease. The benefits are particularly evident in patients with or without diabetes, presenting with proteinuria superior to 3 g per 24 h and they remain significant to a lesser degree when proteinuria is inferior to 3 g per 24 h [8]. Taking this into account, ACE inhibitors and A2RB appear underused, especially in hypertensive patients with renal failure. Considering the prescription of ACE inhibitors and A2RB to the 69 diabetic patients with renal failure and microalbuminuria, 27.5% took ACE inhibitors, 43.5% took A2RB and 5.80% took both ACE inhibitors and A2RB. In the MIRA survey, 45% of hypertensive patients were treated with ACE inhibitors and 35% with A2RB [28]. While our results are comparable to those of the MIRA survey concerning the prescription of A2RB, the prescription of ACE inhibitors seems much lower in our population, suggesting that the prescription of ACE inhibitors could be higher in hypertensive diabetic patients than in patients with renal failure.

Thus, it seems that the treatments at the disposition of practitioners are not used in an optimized way to lower blood pressure and to slow the progression of renal dysfunction, while it has been clearly established that decreasing blood pressure permits the slowing down of progression of complications in the long-term. These complications may not only affect the kidneys, but also the microvascular or even the macrovascular system and particularly cardiovascular diseases.

This survey has limitations, notably concerning the collection of data by GP in a registry, without carrying out any subsequent examinations. For this reason, serum creatinine was reported for only 1959 of 2315 patients initially included in the study, which does not rule out the possibility that the 356 patients without serum creatinine values might have been diagnosed with renal failure. It is therefore possible that the prevalence of renal dysfunction in our study population was underestimated because in 15.7% of patients, serum creatinine was not available. In spite of these limitations, our study provides valuable information on a comprehensive cohort from all over France. We are aware that the use of another formula such as the MDRD formula would have allowed a better estimation of renal clearance, particularly in special populations such as obese or elderly patients. However, the Cockroft and Gault formula remains the most common in scientific literature, enabling us to compare our results with those of other published studies.

Conclusion

Kidney diseases must be searched for because they are initially asymptomatic and their early treatment has been shown to delay the commencement of RRT and to lower the risk of cardiovascular accidents [19]. As highlighted by Bourel and Ardaillou in their 2004 report, the screening of CRF must target at-risk populations, especially those suffering from AH [19].

The administration of an ACE inhibitor or an A2RB as first line therapy seems essential particularly in the case of proteinuria. It must also be remembered that renal dysfunction or proteinuria — which should be routinely tested for — are major cardiovascular risk factors.

Our results show a high frequency of CRF in hypertensive patients, which is in line with the results of other studies conducted among GP. In patients whose GFR is inferior to 60 mL/min per 1.73 m^2, it is only possible to slow down the deterioration of renal function. Yet these patients are insufficiently treated and despite the results of recent epidemiological studies, there seems to be no improvement in the therapeutic management of these patients. Consequently, efforts should be made to properly educate GP in order that they contribute to the early detection of CRF, to better therapeutic management using in particular ACE inhibitors and A2RB which have been proved to protect the

kidneys in hypertensive patients, and to quicker referral of patients to cardiologists and nephrologists.

Conflicts of interest statement

None declared.

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